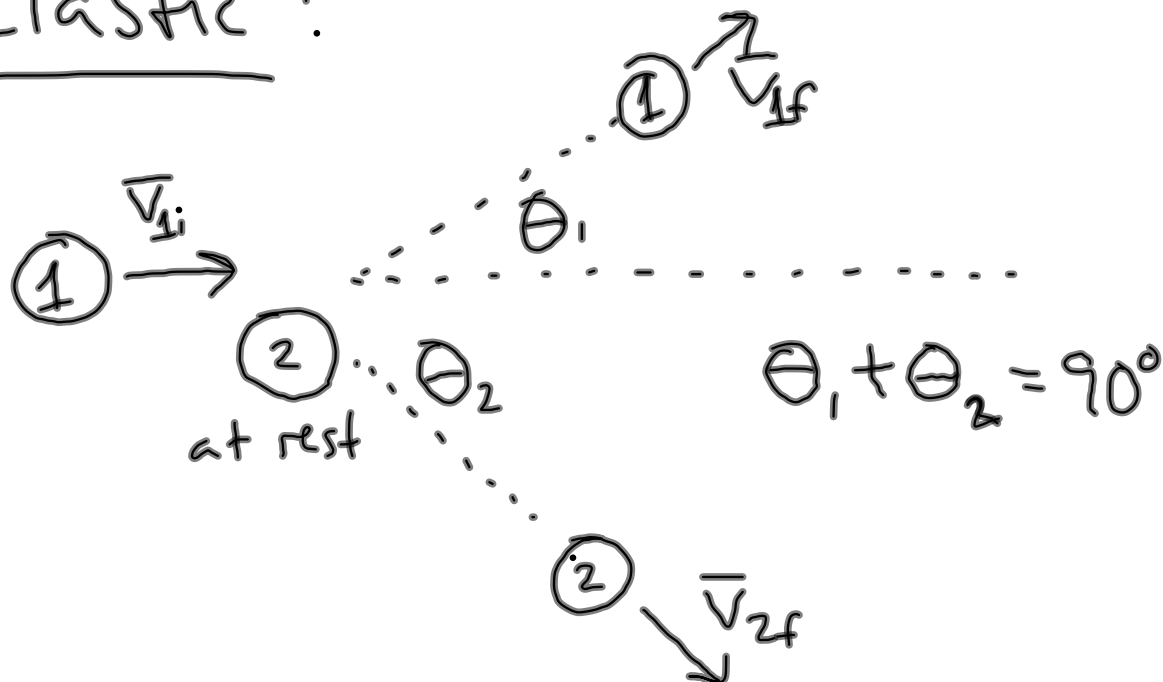
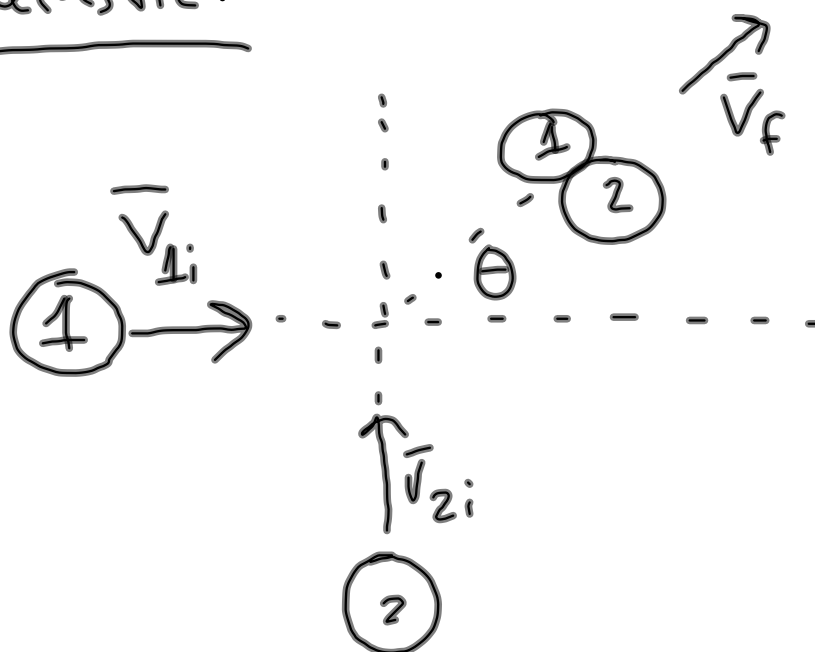


# Momentum in 2-Dimensions:

## Elastic:



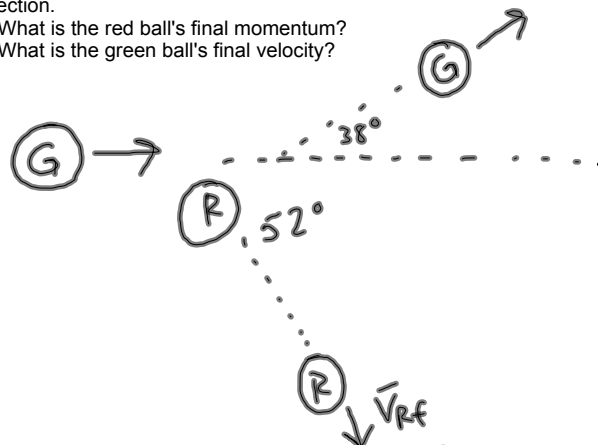
## Inelastic:



## 2D Collisions Notes and Practice Problems 2.8.12 Honors Physics

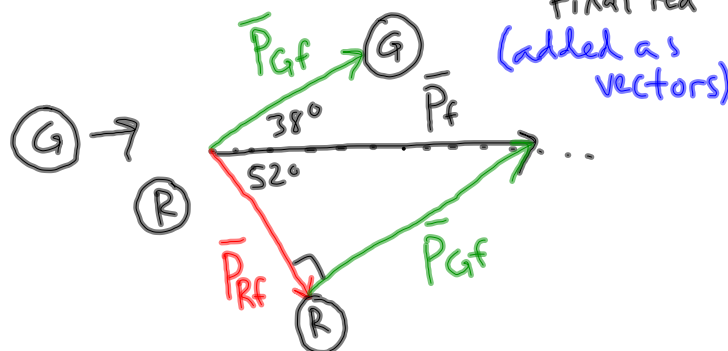
A green 3.00 kg ball moving 12.0 m/s hits a non-moving 2.00 kg ball. After they hit, the red ball is moving to the right at a 52 degree angle from the green ball's original direction. The green ball is now moving at a 38 degree angle to the left of its original direction.

- What is the red ball's final momentum?
- What is the green ball's final velocity?



initial momentum = final momentum

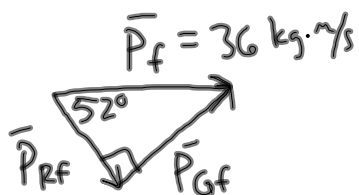
initial green momentum = final green +  
final red  
(added as vectors)



$$\vec{P}_{Gi} = \vec{P}_f$$

$$\vec{P}_f = m_G \vec{v}_{Gi} = (3 \text{ kg})(12 \text{ m/s})$$

$$= 36 \text{ kg} \cdot \text{m/s}$$



$$\cos(52^\circ) = \frac{P_{Rf}}{P_f}$$

$$P_{Rf} = P_f \cos(52^\circ)$$

$$= (36 \text{ kg} \cdot \text{m/s}) \cos(52^\circ)$$

$$= 22.2 \text{ kg} \cdot \text{m/s}$$

b) find final velocity of the green ball

$$\sin(52^\circ) = \frac{P_{Gf}}{P_f}$$

$$P_{Gf} = P_f \sin(52^\circ)$$

$$= (36 \text{ kg}\cdot\text{m/s}) \sin(52^\circ)$$

$$= 28.4 \text{ kg}\cdot\text{m/s}$$

$$\vec{P}_{Gf} = m_G \vec{V}_{Gf}$$

$$\begin{aligned} V_{Gf} &= \frac{P_{Gf}}{m_G} \\ &= \frac{28.4 \text{ kg}\cdot\text{m/s}}{3 \text{ kg}} \end{aligned}$$

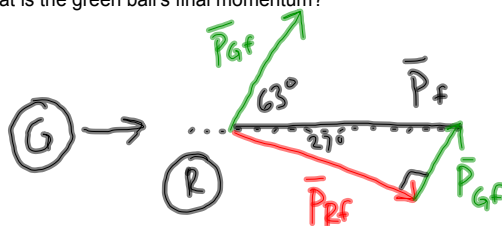
$$= 9.5 \text{ m/s}$$

## 2D Collisions Notes and Practice Problems 2.8.12 Honors Physics

A green 5.00 kg ball moving 17.0 m/s hits a non-moving red 7.00 kg ball. After they hit, the red ball is moving to the right at a 27 degree angle from the green ball's original direction. The green ball is now moving at a 63 degree angle to the left of its original direction.

a) What is the red ball's final velocity?

b) What is the green ball's final momentum?



$$\sum \vec{p}_i = \sum \vec{p}_f$$

$$\vec{p}_{Gi} + \vec{p}_{Ri} = \vec{p}_{Gf} + \vec{p}_{Rf}$$

→ vectors, so MUST vector add!

$$\begin{aligned} p_f &= p_{Gi} \\ &= m_G v_{Gi} \\ &= (5 \text{ kg})(17 \text{ m/s}) \\ &= 85 \text{ kg} \cdot \text{m/s} \end{aligned}$$

a)

$$\cos(27^\circ) = \frac{p_{Rf}}{p_f}$$

$$\begin{aligned} p_{Rf} &= p_f \cos(27^\circ) \\ &= 75.7 \text{ kg} \cdot \text{m/s} \end{aligned}$$

$$\begin{aligned} p_{Rf} &= m_R v_{Rf} \\ v_{Rf} &= \frac{p_{Rf}}{m_R} = 10.8 \text{ m/s} \end{aligned}$$

b)

$$\begin{aligned} \sin(27^\circ) &= \frac{p_{Gf}}{p_f} \\ p_{Gf} &= p_f \sin(27^\circ) \\ &= 38.6 \text{ kg} \cdot \text{m/s} \end{aligned}$$